Advanced Slurry Hydrocracking Process: Technology for Heavy Oil Conversion

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Introduction

The UOP SRC Uniflex™ Process is UOP's Slurry Hydrocracking heavy oil conversion Process. The SRC Uniflex Process comprises elements of the CANMET Hydrocracking Process with UOP Unionfining™ and UOP Unicracking™ Processes. UOP has acquired the exclusive rights to license the CANMET Slurry Hydrocracking Process technology. The CANMET Hydrocracking Process was demonstrated by PetroCanada from 1985 to 2003 [1-3]. UOP is pursuing improvements to the SRC Uniflex Process.

Materials and Methods

For catalyst evaluations, a semi-batch CSTR autoclave was used. The test duration is typically 80 minutes with flowing hydrogen. The catalyst precursor to be evaluated is combined with the feed and pre-mixed for several hours at an elevated temperature. The catalyst has been evaluated with both Peace River Vacuum Bottoms (PRVB) and Ural Vacuum Resid

Results and Discussion

UOP has recognized the emerging need for a cost-effective, high conversion hydrogen-addition upgrading process, and has responded with the SRC Uniflex Process. This is accomplished by close integration of a commercially-proven high-conversion Slurry Hydrocracking Reactor System. Many improvements have been made in the technology. This presentation will focus on the economic benefits of the technology, the available flow schemes, especially for large scale applications, as well as advances in catalyst science, analytical techniques and new product pitch utilization options.

Better process economics can be achieved with lower cost catalysts. New analytical techniques have also been developed to help characterize the feeds and the products from the conversion process. A range of catalyst precursors were evaluated. The performance of the materials can be ranked according to the rate at which they form the active catalyst phase and the crystallite size of the active catalyst. An improved catalyst formulation has been found that can be commercialized at an improved cost structure when compared to the prior catalyst used in the process. The reasons for the improved performance which include the smaller crystallite size of the active phase will be discussed. Several catalyst precursors will be reviewed and reasons for differences in performance will be correlated to some of the properties measured.

Table 1 shows the performance of the improved catalyst compared to the reference. The new catalyst has higher conversion, higher liquid product yields, and or lower catalyst consumption over the traditional slurry hydrocracking catalysts.

Table 1. Comparison of Performance of two catalysts

Catalyst	% Metal (wt%)	Feed	% Conversion	Yield C5-525°C
Reference Catalyst	Base	Bitumen Vacuum Bottoms	Base	Base
Improved Catalyst	0.33 x Base	Bitumen Vacuum Bottoms	+6	+6.5

Significance

The improved slurry hydrocracking technology offers the potential to increase the yields of valuable liquid products used for transportation. Improved flow schemes demonstrate how the technology is used. With a new catalyst formulation it will be offered as part of the UOP SRC Uniflex process expanding the scope of application of the technology to higher conversion operations and to processing more difficult feedstocks.

References

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3. Patmore, D.J., Khulbe, C.P., Belinko, K., ACS, Div Pet.Chem, 26(2) 1981